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CITATION:

Hosoda, Takashi. Evaluation of People's Awareness and Consensus Level to River Improvement Projects with Flood Control and Dam Construction for a Few River Basins. Journal of Disaster Research 2013, 8(1): 161-162

ISSUE DATE:

2013-02

URL:

<http://hdl.handle.net/2433/172080>

RIGHT:

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# Evaluation of People's Awareness and Consensus Level to River Improvement Projects with Flood Control and Dam Construction for a Few River Basins

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**Abstract.** This paper describes the results of the questionnaire to survey the people's awareness to the river improvement projects with the planning of dam construction (the Kouchigawa Dam) for the Kitagawa river running in Obama City and Wakasa Town, Fukui Prefecture. Three categories of Flood Control, Water Supply for irrigation, industries & tap water and Natural Environment Conservation were considered as the objectives of river improvement projects. CVM and Conjoint Analysis were applied for the quantitative evaluation of people's awareness to each project for flood control, water supply and natural environment conservation in the river basin. Approval, neutral or disapproval to the dam construction was also questioned with the evaluation of the willingness to pay (WTP).

**Keywords:** River Improvement Works, Questionnaire Survey, People's Awareness, CVM, Conjoint Analysis

## 1. INTRODUCTION

This paper describes the results of the questionnaire to survey the people's awareness to the river improvement projects with the planning of dam construction (the Kouchigawa Dam) for the Kitagawariver running in the Wakasa-Resion of the Fukui Prefecture.



Fig. 1 The Kitagawa River Basin

Although the river is categorized as Class-A river, which is managed by National Government, the Fukui Pref. is commissioned to manage the upstream part of the main river course and the tributaries. Dam construction (Kouchigawa Dam) with multi-purposes has been planned by Fukui Pref. since early times.

Three categories of Flood Control, Water Supply and Natural Environment Conservation were considered as the objectives of river improvement projects. CVM and Conjoint Analysis were applied to evaluate the people's awareness to each project for flood control, water supply and natural environment conservation in the river basin. Approval, Neutral or Disapproval to the dam construction was also questioned with the evaluation of the willingness to pay (WTP).

## 2. OUTLINE OF QUESTIONNAIRE SURVEY

The general questions including age, occupation, annual income, etc. were put at the beginning of the questionnaire sheet. The part of CVM followed after the general questions. WTPs for the flood control project, the water supply project, the natural environment conservation project and the Kouchigawa dam construction were questioned as the additional tax payment in future 20 years using double-bounded dichotomous choice method (DBDM), payment card method (PCM) and multiple-bounded discrete choice method (MBDCM).

Questions of Conjoint Analysis with choice experiment followed after the part of CVM. In the same way as CVM, the flood control project, the water supply project, the natural environment conservation project and the payment were considered as four attributes. 15 profiles were prepared by combining 3 attributes and payment with a few levels.

1404 questionnaires were distributed to residents in the river basin directly in December, 2009 and answer sheets were returned by mail. The percentage of reply is 23.4% (=329/1404) and the average age is 59.5.

## 3. RESULTS OF CVM

Regarding flood control, the following project was presented, and then each respondent was asked to answer WTP.

## [Flood Control]

**Objectives:** Flood control projects to protect flood vulnerable area from 100 year precipitation

**Current situation:** The colored area has high possibilities to be inundated based on the flood hazard map.

**Result:** Flood vulnerable area is protected from inundation for 100 year precipitation.

Regarding water supply, natural environment conservation and dam construction, the similar explanation of each project was presented to each respondent.

Some results of CVM based on each method are shown in Table 1. Table 1 shows the median of WTPs evaluated by a few method. WTPs of double-bounded dichotomous choice method are larger than ones of payment card method except dam construction. WTPs of payment card is nearly the same as WTP of Probably Yes level. WTP of dam construction is relatively small compared to the other WTPs.

Table 2 shows the ratio of Approval, Neutral and Disapproval to each project. Although the ratios of Approval to Flood Control, Water Supply and Environment Conservation are more than half the number of respondents, the ratio of approval to Dam Construction is about 30% and the ratio of disapproval 16%. Although the demand for the progress of flood control project is relatively strong, people in the river basin seem not to understand the necessity of dam construction fully.

Table 3 shows WTPs of people expressing Approval, Neutral and Disapproval for Dam Construction separately. Regarding people expressing Approval, WTP of Dam Construction by CVM is almost the same as one of Flood Control and Water Supply. People with Disapproval have relatively large WTP for Flood Control and Water Supply compared to WTP of Dam Construction. These people seem to demand the improvement projects without Dam Construction.

## 4. RESULTS OF CONJOINT ANALYSIS

Conjoint Analysis was also applied to survey the people's awareness to the river improvement projects and to compare the results to ones of CVM. An example of the questionnaire is shown in Fig. 2.

Marginal WTPs are shown in Table 4. MWTP for Flood Control (2764yen) shown in Table 4 is roughly the same as WTP of CVM (2324yen) in Table 1. But MWTP for Water Supply (376yen) in Table 4 is much less than WTP of CVM (2098yen) in Table 1.

Table 5 shows MWTPs of people in Obama City and Wakasa Town separately. MWTP on Flood Control of people in Obama City is much larger than one in Wakasa Town, but MWTP on Water Supply in Obama City is much less than one in Wakasa Town. These

**Table 1** Medium of WTP (Unit:Yen)

	Double-bounded dichotomous choice	Payment Card	Multiple-bounded discrete choice			
			Definitely Yes	Probably Yes	Not Sure	Probably No
Flood Defense	3,267	2,324	1,941	2,783	4,207	9,395
Water Supply	2,433	2,098	1,231	1,926	3,376	5,848
Environment Conservation	2,832	1,845	1,279	1,973	3,264	6,019
Dam Construction	1,173	1,342	688	1,047	2,088	3,202

**Table 2** Ratio of Approval, Neutral and Disapproval to each project (Unit:Yen)

	Flood Defense	Water Supply	Environment Conservation	Dam Construction
Approval	58.9%	50.7%	60.4%	29.6%
Neutral	24.4	35.2	29.3	46.7
Disapproval	8.1	8.9	5.9	15.9
No Answer	8.5	5.2	4.4	7.8

**Table 3** WTPs of people expressing Approval, Neutral and Disapproval for Dam Construction (Payment Card Method, Unit:Yen)

	Approval	Neutral	Disapproval
Flood Defense	3,339	2,386	1,592
Water Supply	3,057	2,152	1,307
Environment Conservation	1,503	2,086	1,884
Dam Construction	3,417	1,250	96

Q16-1 If the plans on the improvement projects in the Kitagawa River are presented described below, would you choose the most agreeable plan and the next agreeable plan.

	Plan1	Plan 2	Plan 3	Present State (No projects)
Level of Flood Defense	100 year	100 year	30 year	12 year (present state)
Frequency of Drought	30 year	5 year (present state)	5 year (present state)	5 year (present state)
Environment Conservation	An endangered plant in marsh areas such as Hangesho Japanese river trout	No projects (present state)	An endangered plant in marsh areas such as Hangesho Japanese river trout	No projects (present state)
Payment for each household as an annual additional tax in future 20 years	10000 yen	3000 yen	5000 yen	0 yen

Would you mark ○ on the most agreeable plan. ( Plan 1, Plan 2, Plan 3, Plan 4 )  
Would you mark ○ on the second agreeable plan. ( Plan 1, Plan 2, Plan 3, Plan 4 )

**Fig. 2** Example of the Card with 4 profiles and 4 attributes for Conjoint Analysis

**Table 4** Marginal WTPs to each project (Unit:Yen)

Flood Defense	2,764
Water Supply	376
Plant in Marsh Area (Hangesho)	-2,454
Japanese River Trout	20,171

**Table 5** MWTPs of people in Obama City and Wakasa Town (Unit:Yen)

	Obama City	Wakasa Town
Flood Defence	3,183	-431
Water Supply	-687	3,007
Plant in Marsh Area	-3,193	-1,034
Japanese River Trout	21,131	17,428

results reflect the own demands of people in Obama City and Wakasa Town for many years.